Lobster Research Program

Maine Department of Marine Resources

"The Maine *Cancer* Crab Fishery"

by

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INTRODUCTION

Along the Maine coast, two species of crabs, the rock crab (*Cancer irroratus*) and Jonah crab (*C. borealis*), are caught commercially. These two crabs, which are primarily harvested as an incidental catch in the American lobster (*Homarus americanus*) fishery, support a small but increasingly important fishery which in 1979 had landings of 1,344,179 pounds valued at $213,616 (ex-vessel price).

Since 1966, the price per pound of crabs paid to the fisherman has increased from 4¢ to 16¢ (Figure 1). Consequently, more Maine lobstermen have been selling their incidental catches of crabs (which might have been discarded in the past) to offset the upward spiraling operational costs (bait, fuel, etc.). Considering the increasing commercial value of *Cancer* crabs, higher levels of fishing effort are expected to be forthcoming in the crab fishery. In view of this, the application of biologically sound management practices may be necessary to insure the protection and enhancement of the crab resource.

IDENTIFICATION OF MAINE *CANCER* CRABS

Although the Maine *Cancer* crabs are rather similar in appearance and may be mistaken for one another by the untrained eye, the following characteristics along with the drawings of Figure 2 should enable one to identify each of the two species:

Jonah crab (*C. borealis*)	Rock crab (*C. irroratus*)
1. Top margin of claw lined with small teeth. Generally larger claws than rock crab.	1. Top margin of claw is smooth.
2. Surface of carapace (back-shell) is rough.	2. Surface of carapace is smooth.
3. Walking legs are more slender than rock crabs.	3. Usually displays more "life" than Jonah crab.

In Maine, the fisherman refer to the *Cancer* crabs by a host of common names which seem to be related to the general area or bottom type where the crabs are caught in any one locality. For instance, the rock crab (common name of *C. irroratus* outside Maine) is known by any of these names: sand crabs, bay crabs, eelgrass crabs, river crabs, mud crabs, or limber-legs. To add to the confusion, the Jonah crab (*C. borealis*) is known to most Maine fishermen as the rock crab, although other names, such as bull crab, offshore crab, or sea crab are also used.

DISTRIBUTION

The rock crab occurs in coastal waters of eastern North America from Labrador to Florida (Williams 1974). The depths inhabited range from the intertidal zone (area between low and high tide marks) to about 315 fathoms. In the southern portion of their range, rock crabs are generally found at greater depths where lower water temperatures prevail; however, during the winter months when inshore waters cool, rock crabs have been observed to move shoalward until temperatures rise in spring-summer (Shotton 1973, Terretta 1973).

Jonah crabs are found from Nova Scotia to south of Tortugas, Florida and in the Bermudas (Williams 1974). Like the rock crab, the Jonah crab occurs near the low water mark in the more northern latitudes and offshore in the south. Jonah crabs have been reported in depths up to 437 fathoms. Of the two cancrid crabs, the Jonah crab generally shows preference for greater depths. Observations of several investigators (Jeffries 1966, Haefner 1976, Krouse 1980) indicate that Jonah crabs undertake limited seasonal movements. These movements are probably more pronounced in the crabs' southerly habitats.

Although both cancrid crabs occur along the entire coast of Maine, the distribution and abundance of each species is related to bottom type in association with depth and water temperature (Krouse 1980). Rock crabs are extremely abundant at inshore areas (estuaries and embayments) having sand-mud bottoms, whereas Jonah crabs show preference for more seaward coastal areas having hard bottoms of rock, sand, and clay. This difference in habitat preference has been explained by one researcher (Jeffries 1966) to be due to morphological and behavioral differences between the two species. The generally smaller rock crab, with its greater walking ability, capability for burrowing, and quickness, is better adapted for life on soft, featureless bottoms than its heavy clawed counterpart, the Jonah crab, which is relatively less active and slower, and is dependent upon coarse bottoms not only to attract food organisms, but also to provide shelter from predators.

AVAILABILITY

According to Fishery Statistics of the U.S., the first recorded commercial catch of *Cancer* crabs (not separated by species) in Maine was in 1919 when about 32.2 metric tons were landed (Figure 1). Inter-

estingly, since the catch first peaked in 1930, rather pronounced peaks have occurred about every 10 years thereafter, with the exception of the 1950-60 period when the greatest catch (912.4 metric tons) in the history of the fishery was made in 1963 (13 years after the last peak). Results of sampling by DMR indicate that more than 90% of the commercial crab catch in Maine consists of rock crabs (Cowger 1978).

Fluctuations in the crab catch may be the result of many factors such as overfishing, natural population cycles, and market demand. Explanation of these catch variations is further confounded by the inaccuracy of the landings values. It has been estimated that about half of the commercial crabmeat production in Maine results from unreported "home-picking" operations (Cowger 1978): thus the reliability of the landings data is seriously undermined. Nevertheless, this information still provides a useful approximation of catch size.

The major crab producing areas in Maine are located in the mid-coastal region where large embayments provide suitable conditions for rock crabs (Cowger 1978). The Penobscot Bay - Deer Isle - Blue Hill Bay region is probably the most productive crab area on the Maine coast. Hancock County over the past 30 years has produced about 45% of the Maine crab landings and almost all of those landings come from the Penobscot Bay - Deer Isle - Blue Hill Bay region.

Casco Bay is another productive area, and accounts for about 25% of Maine crab landings. The Sheepscot and Damariscotta Rivers are both fished heavily for crabs and are the only areas in Maine with a closed season. In 1979 and 1980 crab fishermen from the Damariscotta and Sheepscot Rivers, respectively, supported closure of the crab fishery during the winter months when male rock crabs are molting and therefore

of inferior quality. East of Blue Hill Bay there is little crab fishing. Jonesport and Machias Bay are the only regions in Washington County where crabs are caught in any numbers.

VARIATIONS IN AVAILABILITY

During their first 6 to 8 weeks of life, both the Jonah and rock crab pass through six larval stages before molting to the first crab stage (Figure 3) when they first settle to the bottom (Sastry and McCarthy 1973). In the larval period, the young crabs are suspended in the water column and are extremely vulnerable to predation and, depending largely upon ocean currents, may be distributed considerable distances from where hatching occurred.

As might be expected, the larvae of both species have certain temperature requirements for normal development and high survival (Sastry 1977). If significant deviation from the preferred temperature range occurs the abundance of certain size and age crabs may diminish.

Water temperature is not only an important factor on young *Cancer* crabs, but also affects the distribution of adult crabs. For example, along the mid-Atlantic coast the distribution and abundance of Jonah and rock crabs have been clearly demonstrated to be associated with temperatures along with depth and bottom type (Shotton 1973, Terretta 1973, Haefner 1976, 1977). In addition, within the same region crabs undertake seasonal movements, apparently in response to changes in temperatures. In contrast, along the Maine coast where seasonal variations in water temperatures are less (compared to mid-Atlantic coastal waters), *Cancer* crab movement is more limited (Krouse 1972, 1980).

Another important factor affecting crab availability is the fishing activity of man. Unfortunately, without catch and effort information we cannot determine fishing mortality (crabs caught by fishermen) and its effect on crab stocks. However, based on comments of Maine commercial

fishermen and limited catch data with our research traps, after the molting period of male rock crabs in late winter-early spring (Krouse 1972) when many crabs attain harvestable size, the abundance of marketable-sized crabs diminishes throughout the summer (Cowger and Krouse 1978). Although part of this reduction in catch may be caused by crabs moving away from the fishing areas, it appears that the primary reason for the catch decline is the fact that most of the large crabs are caught. Even though this may explain fluctuations in rock crab abundance, the same may or may not be true for Jonah crabs, which are the least understood of the two crab species.

HARVESTING

Although there is a small directed fishery on crabs in Maine, most crabs are harvested by lobstermen as an incidental catch. Thus, the majority of crabs are caught in lobster traps which are either of the traditional wooden or increasingly common wire construction. Variations in the basic design occur along the coast, but all traps have features in common: side entrances ("heads") lead to a bait chamber which in turn leads to a "parlor", from which the entrapped animals are removed when the trap is hauled.

Since 1979 all crab and lobster traps have been required to have either an oblong escape vent at least 44.5 mm (1-3/4 in.) wide and 152.5mm (6 in.) long or two circular escape vents at least 57.2 mm (2-1/4in.) in diameter incorporated in the trap's "parlor." Fishermen who wish to retain market-sized crabs often use the circular vents.

In some areas of the coast, fishermen may set traps exclusively for crabs, particularly during the spring when the lobster catches are generally small.

These fishermen, still usually interested in lobsters, have a number of lobster traps in use, along with traps specifically designed to catch and hold crabs. Although similar to a lobster trap in size and shape, the entrances ("heads") are on top of a crab trap, rather than on the sides. Crabs will crawl vertically over the trap sides much more readily than will a lobster, and by entering the trap through the top, escape is virtually impossible, as neither the rock crab nor the Jonah crab are swimming crabs. Lobsters are only rarely found in crab traps; they may be hesitant to drop through the top heads. Heads on Maine crab traps are usually constructed of Chlorox bottles or similar containers which have had the top and bottom portions removed, creating a smooth cylinder through which the crab drops.

The only other type of crab trap seen by the authors in use in Maine is a trap designed for the blue crab (*Callinectes sapidus*) fishery of the mid-Atlantic states. A crab fisherman in Cobscook Bay, who has fished for rock crabs for 20 years, uses this type, a metal trap which has low side entrances and a parlor above the bait chamber to trap the blue crab, a swimming crab. He claims to have tried the traditional top-head trap and found the blue crab trap superior. He now fishes this trap exclusively.

Bait:

Lobstermen harvesting crabs as an incidental catch do not use any particular bait to attract crabs - whatever is available for lobster bait is what is used (generally ocean perch, herring, alewives, flounder, or hake heads). Most fishermen agree, however, that crabs prefer fresh bait.

Those fishing crab traps have their own preferences for bait; one may prefer fresh mackerel, another dogfish, but being opportunistic each will take what is available. If a small live codfish is taken in a lobster trap, it may be eventually strung up in a crab trap.

Crabs are attracted quickly to bait. Fishermen tending crab traps in productive areas during peak season (late spring, early summer) often haul the traps twice per day, and each time the trap may be filled. Rock crabs, in particular, also leave a lobster trap quickly after the bait is consumed. When lobstermen are unable to tend their traps for several days, the crab catch is smaller than when traps are tended daily (Krouse 1978). Crab trap harvest, on the other hand, is relatively unaffected by frequency of hauling (until the bait is consumed), as the crabs are unable to escape through the top heads.

Handling:

Many lobstermen and dealers refuse to handle crabs, for various reasons. The problems most commonly cited can be summarized as follows:

1) Low value - many lobstermen do not want to bother saving a product which is only worth about 16¢ per pound (or about 5-8¢ per crab) when lobsters are worth from $1.25 to $3.50 per pound. Saving crabs on the boat does require some handling, and separate holding facilities are required. Some lobstermen would prefer to spend their labor hauling an extra dozen traps for lobsters.

2) Difficulty in keeping crabs alive on boats - crabs are not hardy creatures out of water, and care must be provided to ensure that they are kept alive after being placed in the boat. Soft-shell crabs, which are abundant in early spring, are particularly tender.

Simple steps can be taken to minimize drying-out and overheating. Crab loss is not a major problem during the cooler months of spring, but when warmer weather arrives, an occasional dousing of the crabs on board will prevent crab loss. One dealer on Deer Isle, who found that too many dead crabs were being brought in during the summers, has rigged up a small circulating water system for crab storage in lobster boats, and provides the system free to his crab fishermen.

3) High mortality in dealers' storage crates - many lobster dealers have found high crab mortality when crates are stored for more than 2-3 days. Soft-shell crabs store poorly.

Most dealers try to minimize storage time. Many will cull the crabs when they arrive, and fill storage crates only halfway during the summer months. Some will ship 90 lb. crates in the spring and fall, and then drop back to 80 lb. crates during the summer.

4) Fluctuations in demand - several lobstermen and dealers refuse to handle crabs because they have had bad experiences in the past with poorly managed picking facilities buying their crabs only sporadically. This situation is unlikely to happen at this time, as picking facilities are searching hard for supplies, and are likely to provide a firm market.

The above problems tend to occur in the marginal crab producing areas. In areas where crabs are abundant, it is to the advantage of both the lobstermen and the dealers to save crabs and exert the small effort required to keep them alive.

THE CRABMEAT INDUSTRY

Crabs are usually sold by the crate; each crate normally contains about 90 pounds of crabs. A crate of crabs in 1979 sold for an average

of about $14-15 (16¢/lb.). The fishermen usually sell their crabs to wholesale dealers (lobster dealers, in most cases), who in turn cull the crabs and sell to the picking houses. Some fishermen may sell directly to the picking houses.

Although a small number of crabs are sold fresh or frozen at the retail level, the vast bulk of the crabs harvested in Maine are picked out by hand and the meat sold wholesale and retail (usually in 6, 7, or 8 ounce cartons). The crabmeat industry is a small but important coastal industry in Maine, worth well over a million dollars a year. There are about 40 licensed crabmeat picking facilities.

It is only possible to get a rough estimate of the economic value of the crabmeat industry because there are an unknown number of "home pickers" - usually lobstermen's wives or housewives who pick out crabs in their homes, and who sell on the roadside or to the local market. The authors estimate that unreported home-picking may account for perhaps half of the total crabmeat production in Maine. Home-pickers are most prevalent in Hancock and Washington Counties, where they have often made it difficult for the larger, licensed operations with standard business overhead expenses to compete. Sanitary regulations have never been enforced by the State Department of Agriculture.

In general, the demand for Maine crabmeat is greater than the supply, as indicated by the 25% jump in prices to the fishermen from 1978 to 1979. Crabmeat is in particularly high demand during the summer tourist season. Many people prefer crabmeat to lobster meat, and crabmeat is about half the price of lobster meat. Crabmeat is not generally considered to be a substitute for lobster meat - it caters to a separate market.

The twelve largest picking operations on the Maine coast, from Portland to Machias, together produced about 150,000 pounds of crabmeat in 1977, from a total of about 1,250,000 pounds of crabs. Total crabmeat production from all sources for that year may have been as much as double that figure, or 300,000 pounds. Recent expansion of licensed picking facility capability since 1977 is an indication production from these facilities is increasing, and may now account for perhaps two-thirds of total crabmeat production.

The retail price of crabmeat varies from $6-$8 per pound. Using both a conservative estimate of 150,000 total pound of crabmeat produced each year in Maine, and a high estimate of 300,000 pounds, the total value of the product would be:

150,000 lbs. x $6/lb. = $900,000 (low estimate)
300,000 lbs.x $8/lb. = $2,400,000 (high estimate)

The number of people employed in the crabmeat-picking industry fluctuates constantly. Turnover is high, and variations in supply force daily changes in the work force. Therefore, only a rough estimate of the work force can be made. The commercial picking operations employ pickers for the period from April into November. The twelve large commercial picking operations employ approximately 100 workers (mostly in the Portland and Mount Desert Island areas). With the addition of other licensed facilities, there are probably 150 pickers; however, most of the smaller facilities do not pick full-time. Pickers are usually paid by the pounds of meat produced, in the range of $1.00-$1.35/lb., and may pick out anywhere from 2-5 pounds of meat per hour, depending on experience and on the meat yield of the crabs at the time.

Most Maine crabmeat is sold right along the coast, and virtually the entire supply is sold within New England.

MANAGEMENT CONSIDERATIONS

Annual variations in crab landings are probably a result of natural population cycles and overfishing in many areas. Two factors tend to self-regulate the industry: one is that it is not economical to pick meat from crabs smaller than about 90 mm (carapace width) in size, so there is an informal minimum size regulation in the industry; the other factor which has helped protect the population is the small size of sexually mature females; most female rock crabs are under 90 mm in size, and therefore are not harvested. This situation is now changing somewhat, as the high price of traditional lobster bait (alewives, herring, redfish, etc.) has led some lobstermen (particularly in the Casco Bay area) to use small crabs as bait. Continued expansion of this practice may have serious consequences for the crab fishery, and should be watched closely.

There has been recent interest in machine processing of crabs. At present there are two prototype machines in operation which extract crabmeat from hand-picked shell waste. This poses no management problems. However, machine processing of whole crabs could create serious problems, since small female crabs would likely be harvested, possible resulting in a significant reduction of the brood stock.

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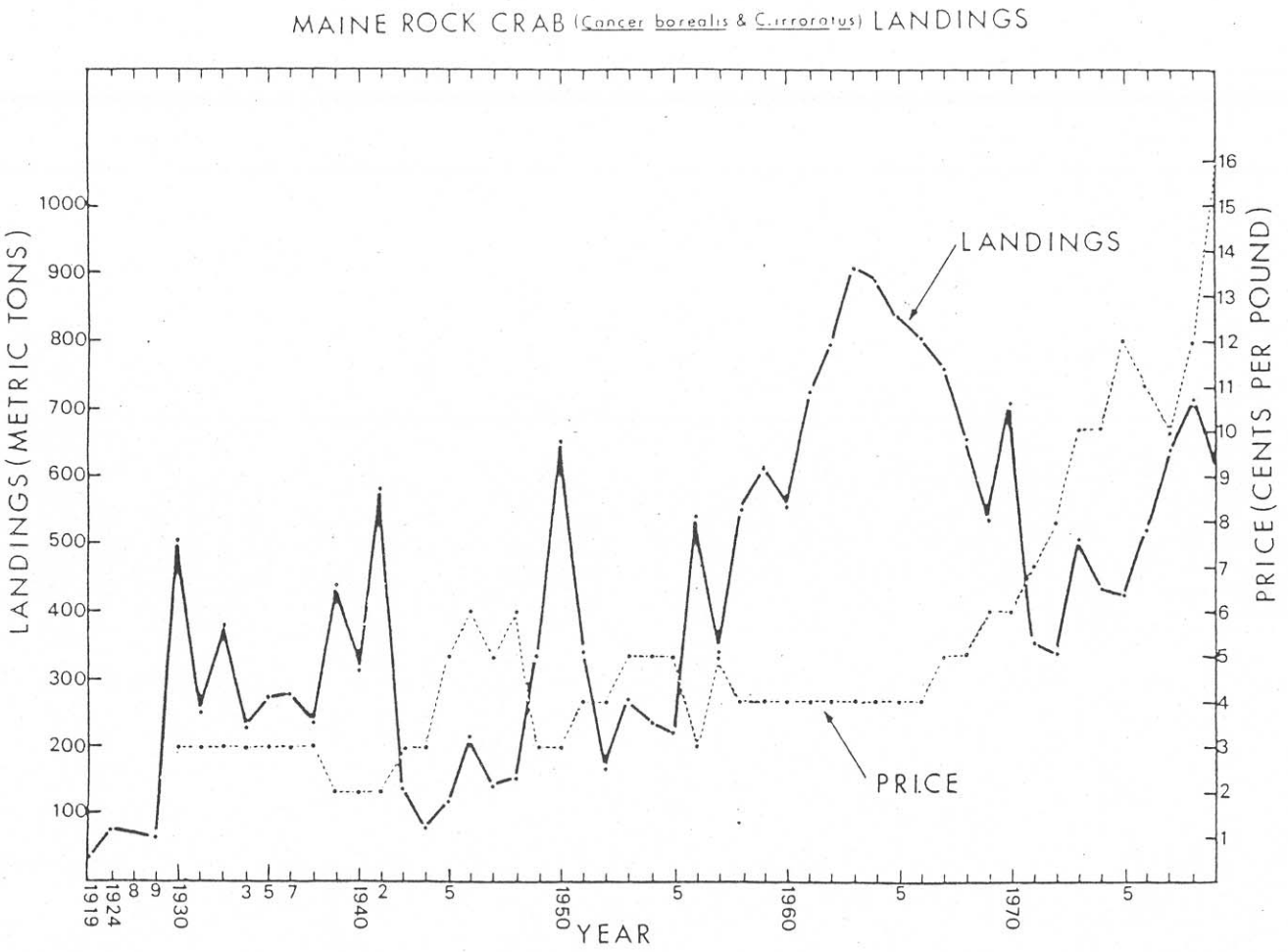
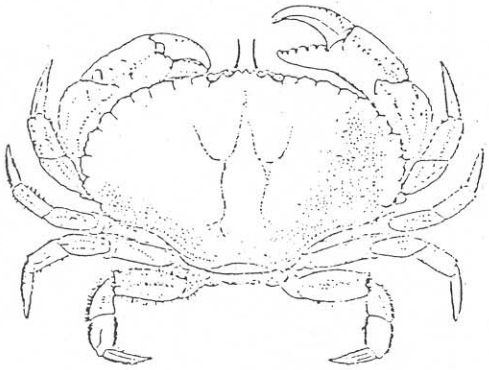
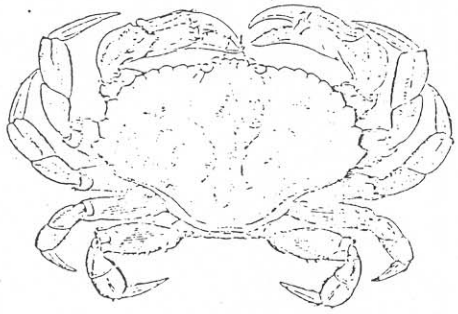


Figure 1. Maine Crab (*Cancer borealis* and *C. irroratus*) landings from 1919-1979.



Jonah crab (Cancer borealis)



Rock crab (Cancer irroratus)

Figure 2. Drawing of the rock (*Cancer irroratus*) and Jonah crab (*C. borealis*) (From Rathbun 1929).

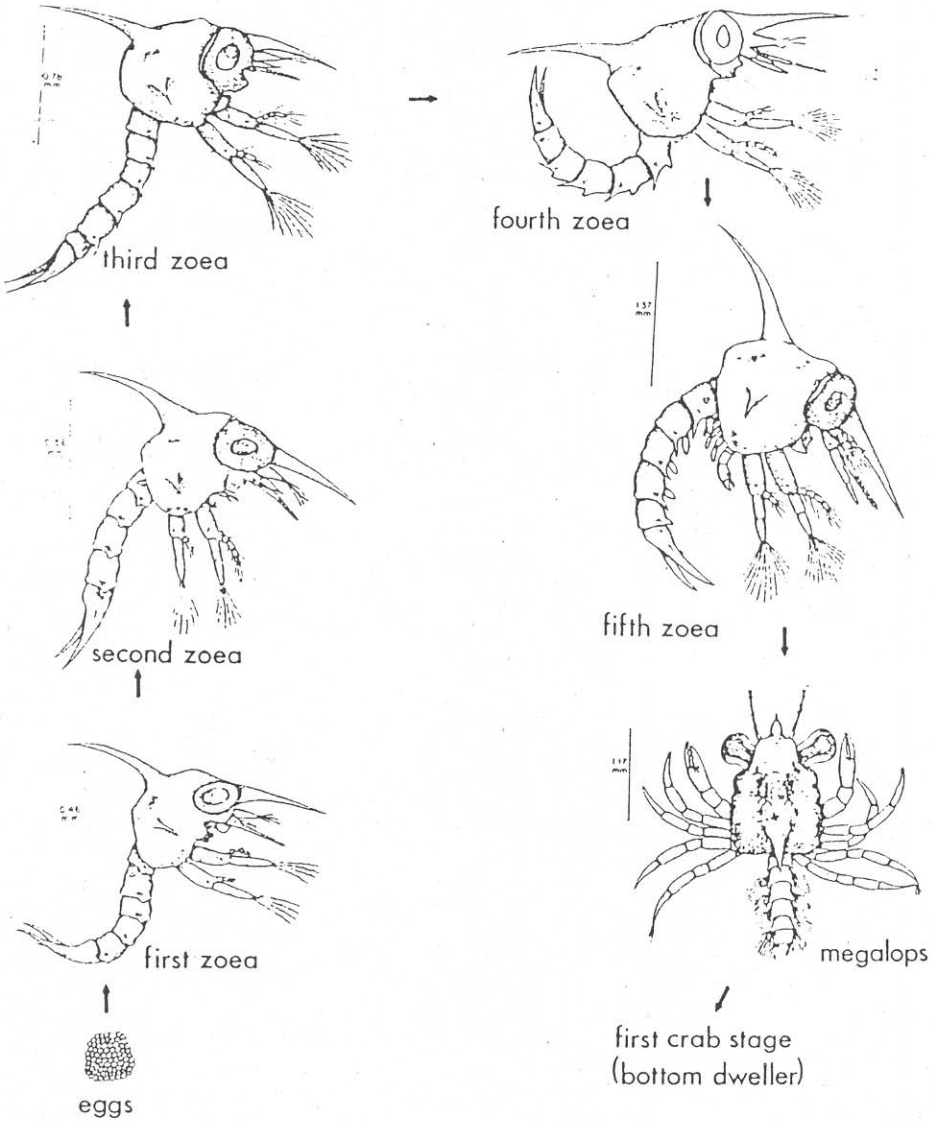


Figure 3. Larval development of the Jonah crab (*Cancer borealis*) (From Sastry 1977).